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Abstract

We use data from the 2020/21 Egyptian Industrial Firm Behavior Survey (EIFBS) to assess the effects of the COVID-19 crisis on firm dynamics, behavior and performance. The crisis emanating from the COVID-19 pandemic induced both demand and supply side shocks, which are more far reaching than any crisis in living memory. Our results show that the crisis has hit the entire Egyptian manufacturing sector. But, in line with Schumpeter's (1934) creative destructive theory, the market shows signs of 'self-cleansing', whereby the less efficient are more likely to exit and downsize their activities. Our descriptive results show resilience of larger, public, formal, and export sector firms. Thus, revealing pre-existing fragilities of the private, informal and, more generally the lower productivity firms in the manufacturing sector. The counter cyclicality of the relation implies that contraction of the formal sector expands the informal as the only alternative way to earn a living. As a 'survival sector', the informal sector has provided 'helping hand employment'. Pre-crisis good managerial practices, innovation, the adoption of advanced technologies and training workers all provide an opportunity for firms to adapt their business model, as reflected by superior firm dynamics and post-crisis performance. Larger firms and mostly less vulnerable sectors such as fabricated metals and rubber have had more access to government support. It is likely that the government has chosen to support sectors with potentially better chances of survival rather than support the most vulnerable. Firms in pharmaceuticals were also recipients of support, which is sensible in a health crisis.

Keywords: COVID-19, pandemic, 2nd wave, firms, firm survival, manufacturing, Egypt.
JEL Classifications: D22, L10, L25, L29.

ملخص

نستخدم بيانات من مسح سلوك الشركات الصناعية المصرية (EIFBS) لعام 21/2020 لتقييم آثار أزمة COVID-19 على ديناميكيات الشركة وسلوكها وأدائها. تسببت الأزمة الناجمة عن جائحة COVID-19 في صدمات في جانب العرض والطلب، والتي كانت بعيدة المدى أكثر من أي أزمة في الذاكرة الحية. تظهر نتائجنا أن الأزمة طالت قطاع الصناعة المصري بأكمله. ولكن تماشيًا مع نظرية شومبيتر الإبداعية التدميرية (1934)، يظهر السوق علامات على "التطهير الذاتي"، حيث من المرجح أن يخرج الأقل كفاءة ويقلص حجم أنشطتهم. تُظهر نتائجنا الوصفية مرونة شركات قطاع التصدير الأكبر والعامة والرسمية. وبالتالي، الكشف عن نقاط الضعف الموجودة مسبقًا في الشركات الخاصة وغير الرسمية، وبشكل عام الشركات ذات الإنتاجية المنخفضة في قطاع التصنيع. تشير التقلبات الدورية المضادة للعلاقة إلى أن انكماش القطاع الرسمي يوسع القطاع غير الرسمي باعتباره الطريقة البديلة الوحيدة لكسب العيش. وباعتباره "قطاعًا للبقاء"، فقد قدم القطاع غير الرسمي "العمالة اليدوية المساعدة". توفر الممارسات الإدارية الجيدة والابتكار واعتماد التقنيات المتقدمة وتدريب العمال فرصة للشركات لتكييف نموذج أعمالها، كما يتضح من ديناميكيات الشركة الفائقة وأداء ما بعد الأزمة. تتمتع الشركات الأكبر حجماً والقطاعات الأقل هشاشة مثل المعادن المصنعة والمطاط بفرص أكبر للحصول على الدعم الحكومي. من المحتمل أن تكون الحكومة قد اختارت دعم القطاعات التي يحتمل أن تكون فرصًا أفضل للبقاء بدلاً من دعم الفئات الأكثر ضعفًا. تلقت الشركات العاملة في مجال المستحضرات الصيدلانية أيضًا دعمًا، وهو أمر معقول في حالة حدوث أزمة صحية.

1. Introduction

Most countries have instituted full or partial lock-down measures to save lives during the COVID-19 pandemic. However, protecting human life has an economic cost. The measures have resulted in a global economic crisis, which has been both a demand shock, and a supply side shock. It has caused changes in the structure of demand. Some sectors have benefitted, such as chemicals, computers and pharmaceuticals. But many others have lost out. In Egypt, the largest falls in demand have been in textiles and clothing, leather, the manufacture of wood and in the manufacture of other non-metallic mineral products such as glass, porcelain, brick and other building materials. It is also a supply side crisis manifesting itself in broken sectoral supply chains as lockdown and other measures impede both (intermediate) production and transportation.

But have firm dynamics and performance in terms of firms closing, job losses, reduced capacity utilization, and drastic reductions in revenues and profits been affected by demand and supply side conditions only? Or is the way by which the crisis affects the economy mediated by how firms respond to changing market conditions?

Crisis present the opportunity for what Schumpeter (1934) called creative destruction. During economic distress, less efficient firms are more likely to exit or to downsize their activities, thereby 'cleansing' the market. Do the Egyptian data support this hypothesis? Is firm survival positively associated with productivity? Are exporting, innovative, high tech firms and those that undertake good management practices more likely to maintain operations, or even just survive? Will such firms exhibit better performance indicators, or has the COVID-19 crisis hit all firms equally hard as argued by Bosio et al. (2020)?

Existing literature on firm survival and performance has emphasized the significant role that investing in R&D and the adoption of advanced technology play.[4] Both innovation and technology show how entrepreneurs interact firm characteristics and strategic behavior to adapt to unfavorable market changes, thus building greater resilience over time (George and Bock 2011). Hall (1987) argues that R&D activities enhance the firm's stock of knowledge and increases the firm's market value and in turn its likelihood of survival. Similarly, investing in innovation increases firm-specific assets and so the competitive position of firms (Esteve-Perez and Manez-Castillejo 2008). Cefis and Marsili (2005) stress the positive impact of innovation on firm survival. Survival probability increases by 11% for innovative firms compared to their non-innovative counterparts. This probability rises to 25% for those innovating in processes in contrast to in production (ibid.). Giovannetti et al. (2011) show that size of the firm combined with technology is a sufficient condition for firm survival. Cefis and Marsili (2019) demonstrate that new firms innovating within

[4] For example, Hall 1987; Perez and Castillejo 2006; Damanpour 1996; Wolfe 1994; Gopalakrishnan and Damanpour 1997; Helmers and Rogers 2010; Bourletidis and Triantafyllopoulos 2014 for SMEs; Giovannetti et al. 2011; Suarez and Ulterback 1995; and more recently Muzi et al. 2021 with evidence from Europe in Wagner 2021.

two years from founding enjoy a long-term adaptive survival premium during and after a crisis. And more recently, Cucculelli and Peruzzi (2020) have shown that adaptive business models have influenced post-crisis firm survival by reducing default probability.

Grover and Karplus (2021) have shown that good management practices such as target-setting, monitoring, incentives and operational practices are also associated with a higher likelihood of survival for manufacturing firms, though is not the case for firms in services. As Pansiri and Temtime (2008) put it, 'managerial effectiveness could by definition have avoided or at least minimized [problems'] impact on firm survival' (p. 252).

Firm characteristics and ownership may also play a role. Egypt preserves many features of its earlier state-led development model, including that public firms operate under a 'soft budget constraint'. Hence, the state provides cheap credit and bails out public companies in crisis (Kornai 1979, Maskin 1999). Hence publicly owned companies may appear more robust with better dynamics and performance indicators. Formality and other institutional setting considerations will also be examined. Industrial and free zones should in theory provide institutional settings conducive to better performance (Porter 1980; Porter 1990; Saxenian 1994; Markusen 1996; Zhang 2016; Audretsch and Dohse 2007, Folta et. al 2006).

We use data from the 2020/21 Egyptian Industrial Firm Behavior Survey (EIFBS) of 2,383 Egyptian manufacturing firms to assess the effects of the COVID-19 crisis on firm dynamics and performance and how these are mediated by firm behavior. By dynamics we mean firm exit and operational status, by behavior we look at firm/entrepreneurial decisions to reduce capacity utilization, labour and working hours; and by performance we refer to changes in production, exports, sales, revenues and profits. We describe the patterns in the data taking into account firm and owner characteristics, managerial practices, innovation, technology adoption, worker training and locational considerations. This will help us assess whether Schumpeter's creative destruction theory holds. We also look at the role of government support and whether this has helped the more vulnerable firms, or large, and publicly-owned firms.

The paper is organized as follows. The next section describes sample and survey design. Section 3 assesses firm dynamics, behaviour and performance. Section 4 addresses government support and section 5 concludes.

2. Sample and Survey Design of the 2020/21 Egyptian Industrial Firm Behavior Survey (EIFBS)

The 2020/21 Egyptian Industrial Firm Behavior Survey (EIFBS) is a new data set of 2,383 manufacturing firms. The data were collected at the beginning of the second wave of COVID-19

extending to the height of it.[5] EIFBS firms comprise a multistage stratified sample drawn from the 2017 economic census sample of 33,331 establishments, which is itself drawn from a sample of 117,149 establishments, the latter covering three other censuses, namely the population, housing and establishments' census.

The EIFBS sample design is based on three parameters to ensure that the sample produces representative and precise estimates at the national level. These parameters are number of employees, region (urban governorates, lower and upper Egypt) and economic activity level (2 digits). The sample frame, however, excludes firms with less than 5 employees and thus is only representative of small, medium and large enterprises (SMEs). This also implies that informal firms – albeit present - are underrepresented in our sample.

We oversampled by selecting a sample of 3,149 establishments in order to be sure to obtain the target number of 2,200.

First, the sample was allocated proportionally among the three regions (urban governorates, lower Egypt, and upper Egypt), which cover 99.2% of industrial establishments in Egypt. A systematic random sample was drawn to select three governorates from each region using Probability Proportional to Size (PPS). The industrial establishments in each region were allocated among governorates proportional to their size (measured by employment). Next, a systematic random sample was used to select the establishments in each governorate after sorting the establishments according to the number of employees and economic activity at the 4 digits level. Annex 1 gives the methodology for the sampling weights.

Two questionnaires were administered, one for firms that are still in operation, and another, very similar one[6], for firms that have exited the market or have temporarily shut down operations. The response rate is 75%, meaning that we successfully interviewed 2,383 establishments of which 2338 are in operation and 45 firms that either have exited the market or are temporarily closed. Of the 766 firms we could not interview, an unknown number, and presumably a much higher proportion, have also exited the market.

The questionnaire has 14 modules: basic firm identification data, firm size, firm expectations on recovery and potential exit, changes in firm performance, pandemic transmission channels, ownership and management characteristics, innovation, management practices and use of IT, production costs, obstacles to operation, exports and global value chains, obstacles to exports,

[5] Precisely between November 19th 2020 and the 5th of February 2021.
[6] Only four modules are slightly different. The main difference is that for temporarily closed or closed firms there are no values for current variables such as production, exports, employment or revenues.

worker training and government support.

A note on Egyptian bakeries is warranted. Bakeries are to be found on nearly every street in residential areas in Egypt, representing about 30% of all industrial firms. Unlike other micro and small enterprises, bakeries in Egypt have an incentive to formalize in order to be able to collect the bread subsidy from the government. Given protection afforded by the subsidy and the nature of their product which is an inferior good (i.e. demand goes up as income falls), bakeries likely exhibit different behavior to their non-bakery food sector counterparts, as well as other micro and small enterprises and formal counterparts. Their inclusion in the sample therefore strongly affects firm dynamics in the manufacturing sector as captured by a number of behavioral and performance variables. We report below if they are included in the analysis or not.

3. Impact of COVID-19 on Firm Dynamics, Behaviour and Performance

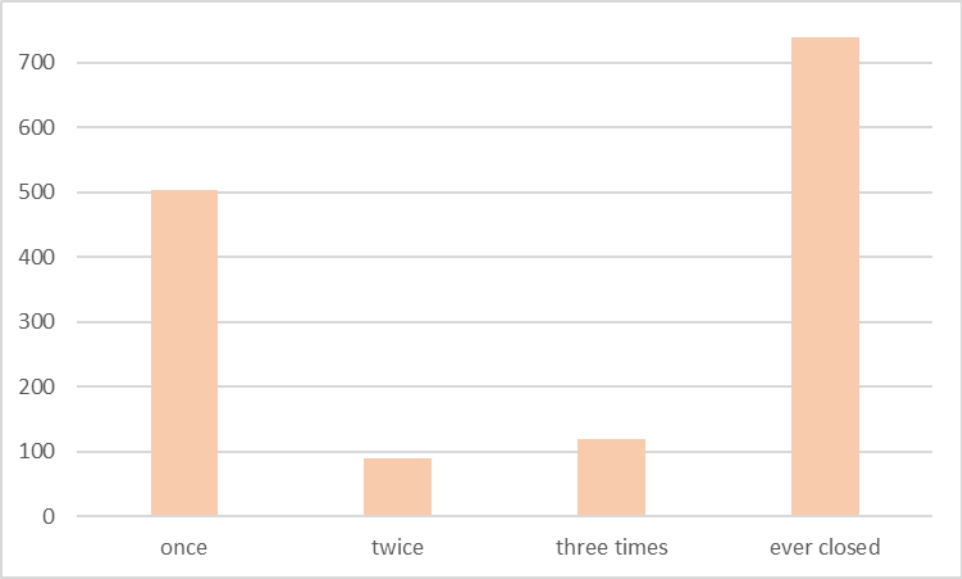
To mitigate the spread of the virus the Egyptian government instituted a partial lockdown as of March 2020. The lockdown restricted opening hours and movement with the exception of grocery shops and supermarkets (El-Tawil 2020). Further restrictions were introduced in April which lasted until the end of May 2020. Another round of less strictly enforced restrictions were introduced during the second wave of COVID-19 from December 1st 2020 to January 2021.

In this section, we document firm dynamics and the economic damage or prosperity done to the range of Egyptian manufacturing firms from the COVID-19 pandemic. Not only do we look at their performance but we also examine their behavior. We further detail this analysis by a range of determinants from firm and owner characteristics to location and management practices, the latter including innovation and use of IT and technology.

3.1 Firm Dynamics: Operational Status, Closures and Exit

At the time of the interview, only 1856 firms remained in full operation. Over one-fifth (22%) of the sample's firms have either exited, temporarily closed or were only partially functioning. Moreover, since the start of the pandemic around 31% of all firms have at least once been temporarily closed (68% once, 12% twice and 16% three times, Figure 1).

Figure 1. Frequency of Closure since Start of the Pandemic



Source: Authors' own elaboration using EIFBS data.

Table 1 shows the dynamics of firms by different types of characteristics and presents the overall patterns in the data. Trends which been found elsewhere round the world are also shown in the Egyptian data. It is also clear that firm characteristics and management practices are associated with firm dynamics.

Firm Characteristics

We define SMEs as those firms with fewer than 100 employees, otherwise they are considered large (Table 1). We employ a strict definition of formality. A firm is formal if it has a commercial registry, an operating license and a tax record. Firms are more likely to be fully functioning if they are larger, formal and exporters. The sample covers 82% SMEs, 7.2% informal firms[7] and 2.7% exporting firms.

- Larger (85% of firms are fully functioning compared to 77% of SMEs)
- Formal (82% of formal firms are fully functioning compared to 66% of informal)
- Exporters (88% of all exporting firms are fully functional compared to 78% of non-exporters)

Table 1 below is based on the entire sample, we report below how the exclusion of bakeries affects the results. Table A1 in Annex 2 gives all results of the sample excluding bakeries. Excluding the bakeries sharpens the results so that an additional 10% of larger firms are fully functioning, an additional 8% of formal firms and an additional 8.4% of exporters compared to their counterparts. The same pattern is evident for the "ever been closed" variable. For example, an additional 15,6% of SMEs have ever been closed since the start of the pandemic.

[7] The sample is drawn to be representative of geographical location, manufacturing sectors and firm size. It is not representative of micro and thus also of formality status, instead it underrepresents informality.

Public firms are normally shielded from the effects of exogenous shocks through a soft budget constraint as will be described further in the paper. Most recently, Liu et al. (2021a) have shown that firm survival is associated with state ownership. This is clearly present in the data. An outstanding majority of public firms (96%) are fully functioning and only 4% have ever been closed since the start of the pandemic (Table 1). This is compared to just 76% and 33% of private firms. Female owners are slightly less likely to be fully operational (74%) and to have ever been closed since the start of the crisis (32%) compared to their counterparts (79% and 30% respectively).

Table 1. Closures and Operational Status

			Current Status of the Firm				Ever closed since start of COVID		Total
			Exited	Temp. closed	Partially functioning	Fully func.	YES	NO	
Firms' characteristics	Size	SMEs	0.3%	1.6%	21.1%	77.0%	30.9%	69.1%	100%
		Large	0.0%	1.0%	14.5%	84.5%	27.8%	72.2%	100%
	Formality	Informal	0.0%	3.4%	30.9%	65.7%	36.8%	63.2%	100%
		Formal	0.4%	1.0%	16.8%	81.8%	28.5%	71.5%	100%
	Exp. Status	No	0.3%	1.6%	20.4%	77.8%	30.5%	69.5%	100%
		Yes	0.2%	0.3%	11.1%	88.4%	26.5%	73.5%	100%
	Ownership	Public	0.0%	0.1%	4.2%	95.7%	4.4%	95.6%	100%
		Private	0.3%	1.7%	21.6%	76.4%	32.7%	67.3%	100%
Location	Indus Zones	No	0,0%	1,9%	20,7%	77,4%	27,2%	72,8%	100%
		Yes	1,1%	0,5%	18,8%	79,7%	41,1%	58,9%	100%
	Free Zones	No	0,3%	1,5%	20,4%	77,9%	30,1%	69,9%	100%
		Yes	0,0%	4,1%	15,1%	80,8%	42,3%	57,7%	100%
	QIZ	No	0.3%	1.6%	20.2%	78.0%	30.2%	69.8%	100%
		Yes	0.6%	1.3%	21.8%	76.2%	40.1%	59.9%	100%
Owner's characteristics	Female Own.	No	0.3%	1.6%	19.6%	78.5%	30.3%	69.7%	100%
		Yes	0.0%	1.4%	24.7%	73.9%	31.7%	68.3%	100%
	Female M	No	0.3%	1.7%	20.0%	78.0%	30.7%	69.3%	100%
		Yes	0.0%	0.3%	21.8%	77.8%	28.6%	71.4%	100%
	Education	Below sec.	0.0%	0.0%	19.6%	80.4%	22.9%	77.1%	100%
		Secondary	0.6%	2.0%	22.0%	75.5%	32.4%	67.6%	100%
		Bachelor	0.1%	1.7%	18.4%	79.8%	30.9%	69.1%	100%
		Above	0.0%	0.0%	22.2%	77.8%	33.9%	66.1%	100%
	Experience	No	0.1%	1.4%	13.1%	85.5%	25.4%	74.6%	100%
		Yes	0.4%	1.7%	24.3%	73.6%	33.2%	66.8%	100%
Management practices, technology and innovation	Technology	No	0.3%	1.7%	21.5%	76.5%	30.8%	69.2%	100%
		Yes	0.0%	1.0%	15.7%	83.4%	29.2%	70.8%	100%
	R and D	No	0.3%	1.7%	21.4%	76.6%	31.4%	68.6%	100%
		Yes	0.0%	0.1%	8.2%	91.7%	20.9%	79.1%	100%
	Good Mng. Practices	No	0.3%	1.8%	26.1%	71.8%	30.8%	69.2%	100%
		Yes	0.2%	1.1%	9.8%	88.8%	30.0%	70.0%	100%
	Training	No	0.4%	1.7%	24.6%	73.2%	29.9%	70.1%	100%
		Yes	0.2%	1.4%	16.5%	82.0%	31.0%	69.0%	100%

Source: Authors' own elaboration using EIFBS data.

Management Practices in Human Resources, Innovation and Use of Technology

A larger share of firms whose managers utilize technology such as computers, the internet, internal information link networks, distributed machine control systems and quality control systems are fully functioning (83%) compared to their counterparts (77%). The literature has long confirmed the crucial role of technology in firm survival (cf. Suarez and Ulterback, 1995, and more recent evidence from Europe in Wagner, 2021). In a similar vein, a larger share of firms whose managers carry out R&D in house (innovation) are fully functioning (92%) and a smaller share of them has ever been closed since the start of the pandemic (21%) compared to 77% and 32% respectively of firms whose managers do not undertake R&D. This is consistent with a large body of literature (cf. Hall 1987; Esteve-Perez and Manez-Castillejo 2008; Damanpour 1996; Wolfe 1994; Gopalakrishnan and Damanpour 1997; Helmers, C., & Rogers, M. 2010).

Moreover, a larger share of firms whose the managers had either monitored any performance indicators or set any production targets prior to the COVID-19 crisis are fully functioning (89%), partially functioning (10%) and a smaller share has exited the market compared (0%) to firms whose managers do not adopt these practices (72%, 26% and 0.3% respectively). Likewise, a larger share of firms whose managers have trained their workers prior to the pandemic are fully functioning and a smaller share has exited or is temporarily closed. It is standard in the literature that good managerial practices are essential in boosting firm survival and performance (cf. Delaney and Huselid 1996, Verbeeten 2008, Lakhal et al. 2006).

Removing bakeries from the analysis makes significant changes to the results. Some firm characteristics are more strongly associated with the likelihood of the firm being fully functioning. Specifically, technology, innovation, good management practices and training increase the likelihood of being fully functioning by an additional 12,1%, 9.8%, 14,2% and 10.1% respectively.

Location and Institutional Setting

Building well-functioning institutions – such as those necessary for contract enforcement and protection of property rights - and providing suitable infrastructure and financial systems for industrial production country-wide is a challenging task which faces economic and political obstacles (cf. El-Haddad 2015; El-Haddad 2008; El-Haddad 2020a). Industrial zones allow the creation of 'parallel structures' that can circumvent institutional constraints in developing countries in a limited geographical area. Free zones also offer better access to suppliers and markets, labour market pooling, spillover of technological know-how, and allow developing countries to make better use of their strong social capital based on trust relationships within the zone or cluster (cf. Porter 1980; Porter 1990; Saxenian 1994; Markusen 1996; Zhang 2016, Audretsch and Dohse 2007, Folta et. al 2006).

Industrial Zones were first established in Egypt in the 1970s under law 65 in 1971 and law 43 in 1974 to encourage exports and attract private investment (El-Haddad 2010). The second generation

of industrial zones were mostly established in new cities such as Al Badr and Al Obour. In the 1990s there were 88 zones (Asal 2009; IDA 2012; UNIDO 2004). Currently there are 109 industrial zones distributed across the country's 26 governorates, with the exception of Gharbeya. Between 2003-2010 free zones, other special economic zones (SEZs) were upgraded and others established, such as the Qualifying Industrial Zones, with better infrastructure, further simplification of their procedures, and with tax and customs concessions remaining to further promote exports and investment (Ministry of Foreign Trade 2003).

In theory, these zones also introduced advanced technology and are hoped to create job opportunities, being treated as offshore areas in which firms are granted tax exemptions and custom privileges. Some free zones offer complete exemption from private and corporate income taxes. Other benefits include low land rental costs and utilities rates (ADB 2012). Industrial zones on the other hand were intended to be independent industrial towns. Industrial and free zones are also divided into private and public zones.

The arguments of firm dynamics can go both ways. A firm in an industrial zone is more likely to remain in operation in a crisis simply because it is more productive, thus can afford to pay its wages, and fixed costs even if it is not making sufficient revenue. On the other hand, a firm in an industrial zone has more exposure to the crisis given its dependence on the global economy. Moreover, it is also a formal firm and so is more likely to have had to fully observe lock-down measures. The results show that firms in both free and industrial zones are only slightly more likely to be fully functioning than other firms, and that they are in fact disproportionately more likely to have ever been closed since the start of the pandemic (Table 1). Similar results can be found for firms in Qualifying Industrial Zones (QIZ).

Removing bakeries from the analysis – which are to be found in any of the zones but also in non-zone areas around the country- accentuates the differences, for example 12% more of the firms located in industrial zones (8.3% in QIZ) were fully functioning compared to firms not located there.

Owner's Characteristics

Accounting for over half of the fully functioning firms in the sample (52.3%), the food sector has been the most resilient manufacturing sector. This factor outweighs the importance of some owner characteristics. This is likely due to the fact that about 60% of owner's with below secondary level – the lowest educational level – are concentrated in the food, beverage and tobacco sector with half of them being in bakeries. In addition, around 40% of owners with secondary education are in bakeries. Similarly, about a quarter of owners with over 20 years of experience are in the food sector. With bakeries representing 38% of all fully functioning firms in the sample. Excluding bakeries, owners with a graduate degree (Masters or PhD) are 6.4% more likely to be fully functioning compared to those with below secondary education.

Although generally, owners' educational attainment level does not seem to make much difference to firm dynamics given that the manufacturing sector relies heavily on blue collars who are rather unskilled (Aboushady and Zaki, 2021).

3.2 Firm Behavior and Performance in Times of COVID-19

How did firms behave during the pandemic? Did they reduce their capacity utilization, employment levels or working hours? How has their performance been affected? Are there differences in behavior and performance by firm or owner characteristics or management practices?

Since bakeries' behavior and performance is different from the rest of their non-bakery counterparts and the rest of the manufacturing sector, we removed the 243 bakeries in the sample (10% of the sample and 30% of the weighted sample). Including them would have smoothed out the averages reported here and hid some of the interesting nuances. The sample used in this section is representative of Egypt's manufacturing sector other than bakeries.

Changes in Behaviour

Overall changes in capacity utilization have been most substantial, with 69% of firms overall reducing capacity. The smallest changes have been in employment, with 32% of firms reducing employment. Changes in working hours fall in between, with decreases in 41% of firms. The minimum reduction in employment has been one employee and the largest 810.[8]

The largest reductions in capacity utilization have been in the manufacture of textiles, non-metallic minerals[9], paper and paper products, furniture and garments sectors. These are predominantly sectors where Egypt has a comparative advantage in and thus those that were strongly hit by the decline in global demand. Over 80% of firms in those sectors reported reductions in capacity utilization.[10] Our survey misses firms that have shut down following COVID, but it has been reported that about 20-30% of all textiles and clothing firms have done so (Talaab, E. 2021). Similarly, the president of the chamber for craft industries – which represent part of the non-metallic mineral sector - reported substantial closures and predicted a decline of 50% in sales (Al-Mohem 2020). In our data, 83% of firms in the non-metallic minerals experienced a decline in capacity utilization and an even greater (86%) decline in revenue.

A clear pattern in the data is that larger, public and exporting firms have reduced their capacity utilization and employment much less than their counterparts have. For example, only 47% of large firms have reduced their capacity utilization compared to nearly three-quarters of SMEs (74%, Table 2). Consistent with this substantial reduction in capacity is the fact that more SMEs

[8] In the fabricated metals sector except machinery.
[9] For example: glass, porcelain, brick, building materials and porcelain tableware, cement and lime.
[10] Not shown available from the authors upon request.

have indeed reported significant liquidity constraints (more than 1.5 times the share of large firms).[11] Fewer layoffs in exporting firms could be explained by those firms being bound by the labour law, which makes them less flexible than informal sector firms. On the other hand being more productive better shielded them from the shock.

For formal firms this is only true of capacity utilization. Over 96% of informal firms have reduced their capacity utilization compared to just 67% of formal firms.

Disproportionately more formal firms have reduced working hours compared to those in the informal sector. Indeed over a quarter (26%) of informal firms have increased their employment. The latter seems puzzling, but has a number of possible explanations. A more likely one is that the informal sector is a survival sector. The informal sector in Egypt is labour intensive and the productivity of its participants is too low to allow them to operate in the formal sector with the additional costs of formalization (La Porta and Shleifer 2014). These characteristics imply that the relation between the sectors will be counter-cyclical: contraction of the formal sector expands the informal as an alternative path to earning a living. Tansel and Ozdemir (2019) and El-Haddad and Gadallah (2021) demonstrate this relation for the Egyptian case. The Egyptian labour market is segmented along formal-informal lines, workers participate in informal work to escape unemployment as they are forced out of formal employment which supports the traditional dualistic view of the economy (ibid.). This counter-cyclicality argument was introduced in earlier literature on informality (cf. Fields 1975, Dickens and Lang's 1985).

Thus, in Egypt the informal sector is the 'employer of last resort', meaning that people laid off or with reduced hours may have been taken on in the informal sector. This would be especially likely for extended family members to be absorbed into an informal business, but this 'helping hand employment' may also extend to the larger social network of rights and obligations which underpin poorer communities in Egypt. It has been estimated that around half of the 450,000 workers who have been working in textiles and clothing in the city of El Mahala have been laid off and turned to employment in the informal sector (Talaab, E. February 2021).

[11] Not shown. Results available from the author upon request.

Table 2. Behavior by Firm Characteristics

	Size		Sectoral Ownership		Formality		Export Status	
	SMEs	Large	Public	Private	Informal	Formal	Non-exp.	Exp.
Change in capacity utilization								
Decrease	73,8%	46,5%	34,7%	70,1%	96,3%	66,8%	69,2%	57,7%
No change	25,8%	52,7%	64,9%	29,5%	3,7%	32,8%	30,4%	41,9%
Increase	0,4%	0,8%	0,4%	0,4%	0%	0,005%	0,4%	0,5%
	100%	100%	100%	100%	100%	100%	100%	100%
Change in employment								
Decrease	34,1%	24,3%	25,9%	32,6%	30%	32,5%	32,6%	19,6%
No change	58,7%	69,4%	66,9%	60,4%	43,6%	61,9%	60,4%	70,5%
Increase	7,2%	6,3%	7,3%	7,0%	26,4%	5,6%	7,0%	9,8%
	100%	100%	100%	100%	100%	100%	100%	100%
Change in working hours								
Reduction	41,6%	38,7%	39,1%	41,1%	32,7%	41,7%	41,1%	40,8%
No reduction	58,4%	61,3%	60,9%	58,9%	67,3%	58,3%	58,9%	59,2%
	100%	100%	100%	100%	100%	100%	100%	100%

Source: Authors' own elaboration using EIFBS data.

Firms in industrial zones have behaved similarly to their non-industrial zone located counterparts with around 70% of firms reducing their capacity utilization (Table 3). But there are differences in behavior for firms located in free zones and even more so for firms in QIZs, with a lower percentage of firms in those locations decreasing their capacity utilization (58% and 44% respectively, Table 3) compared to non-zone firms (69% and 70%). The differences with respect to changes in employment and in working hours are negligible with the exception of firms in industrial zones and QIZ zones reducing working hours more than their counterparts, whereas this is not the case for firms located in free zones.

Table 3. Behavior by Location

	Industrial Zone		Free Zone		Qualifying Industrial Zone	
	No Indus. Zone	Indus. Zone	No Free Zone	Free Zone	No QIZ	QIZ
Change in capacity utilization						
Decrease	69,1%	68,4%	69,2%	58,4%	70,0%	43,7%
No change	30,6%	30,8%	30,3%	40,8%	29,6%	55,9%
Increase	0,3%	0,7%	0,4%	0,8%	0,4%	0,3%
	100%	100%	100%	100%	100%	100%
Change in employment						
Decrease	33,2%	30,6%	32,4%	31,3%	32,5%	30,0%
No change	59,0%	63,9%	60,5%	64,2%	60,6%	61,0%
Increase	7,8%	5,5%	7,1%	4,5%	6,9%	9,0%
	100%	100%	100%	100%	100%	100%
Change in working hours						
Reduction	39,6%	43,8%	41,3%	32,4%	40,4%	57,0%
No reduction	60,4%	56,2%	58,7%	67,6%	59,6%	43,0%
	100%	100%	100%	100%	100%	100%

Source: Authors' own elaboration using EIFBS data.

Reductions in capacity utilization are lower the higher the education level of the owner (Table 4). In addition, female owners and female managers are more likely to have increased employment compared to male owners and managers, but they have reduced working hours significantly more. Reduced hours were introduced by 52% of female owners and 59% of female managers compared to just 39% of male owners and male managers. This is likely because of the association between women in top management positions and the use of advanced technologies compared to men; whilst 55% of all women in top management employ advanced technologies only 27% of male managers do. For female and male owners, the figures are 38% and 29% respectively. The same is true for R&D activities: one third of women managers invest in R&D, whilst just 10% of male managers do. These relationships will become clearer with a multivariate analysis which is reported in a separate paper.

Table 4. Behavior by Owner's Characteristics

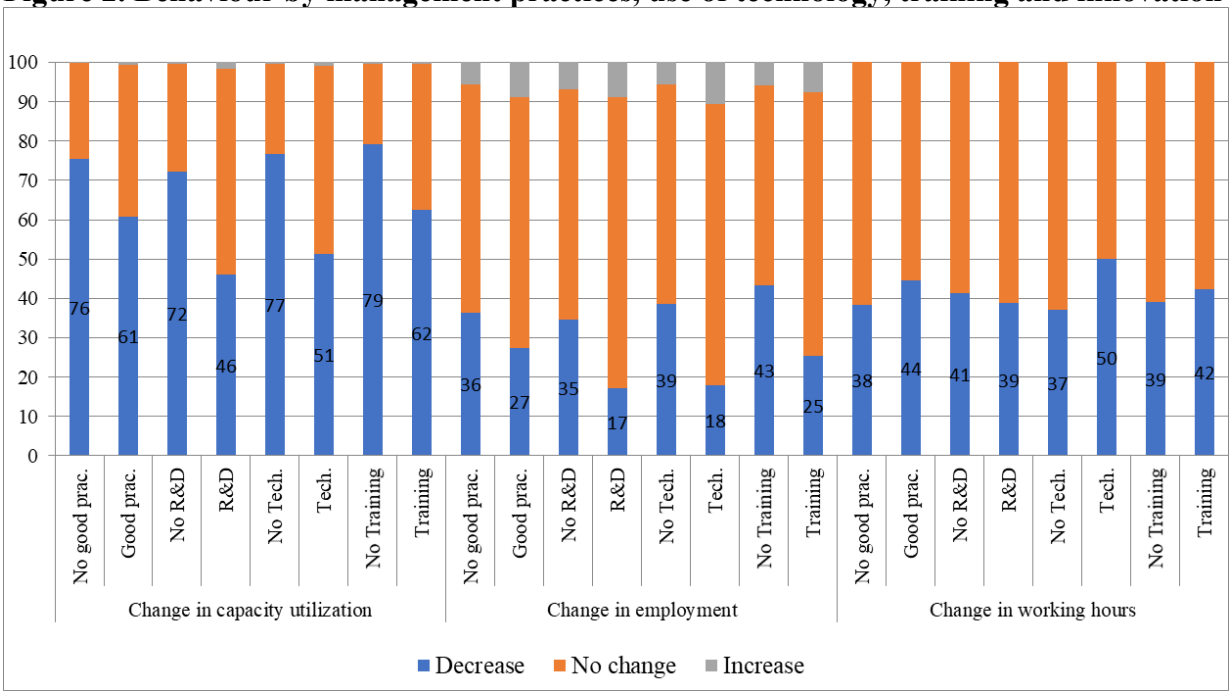
	Education				Experience		Gender			
	Below sec.	Second ary	Bachelor	Above	No exp.	Exp.	No fem. Own.	Fem. Own	No fem mng.	Fem. Mng.
Change in capacity utilization										
Decrease	73,4%	70,5%	67,4%	53,9%	68,4%	69,1%	68,2%	73,9%	69,5%	64,3%
No change	26,6%	29,2%	31,9%	46,1%	31,5%	30,4%	31,6%	24,3%	30,2%	33,9%
Increase	0,0%	0,3%	0,7%	0,0%	0,2%	0,6%	0,2%	1,8%	0,3%	1,7%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Change in employment										
Decrease	32,9%	39,1%	26,7%	34,5%	21,8%	37,4%	32,2%	33,0%	32,7%	29,2%
No change	48,0%	60,2%	64,5%	46,8%	70,4%	55,9%	61,1%	57,7%	60,7%	60,0%
Increase	19,1%	0,7%	8,8%	18,7%	7,8%	6,7%	6,7%	9,3%	6,6%	10,8%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Change in working hours										
Reduction	38,3%	35,6%	46,3%	35,8%	41,5%	40,4%	39,4%	52,1%	38,9%	58,9%
No reduction	61,7%	64,4%	53,7%	64,2%	58,5%	59,6%	60,6%	47,9%	61,1%	41,1%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: Authors' own elaboration using EIFBS data.

Good management practices, technology adoption, innovation and worker training prior to the COVID-19 crisis are all clearly associated with fewer reductions in capacity utilization and fewer layoffs (Figure 2). Less clear is the reduction in working hours, which is more or less equal for all for firms across those categories. The literature shows that a greater use of technology and innovation (Muzi et al. 2021) and better management practices (Grover and Karplus 2021) such as quality assurance and the monitoring of targets are associated with manufacturing[12] firms being more resilient to shocks. These results indicate the relevance of the ability to adapt to market conditions as a determinant of firm survival.

[12] Which is not true of the services sector *(ibid.)*

Figure 2. Behaviour by management practices, use of technology, training and innovation



Source: Authors' own elaboration using EIFBS data.

Effects on Firm Performance

The section presents findings with respect to how firm performance has been affected by COVID-19, including differences in this impact by firm and owner characteristics and management practices. Tables 6-8 and Figure 3 show changes in self-reported demand, production, exports and profits, and revenue calculated from monetary revenue values reported by the firm. Productivity is calculated as revenues divided by the number of workers.

Table 6. Performance by Firm Characteristics

	Size		Sectoral Ownership		Formality		Export Status	
	SMEs	Large	Public	Private	Informal	Formal	Non-exp.	Exp.
Change in demand								
Decrease	80,8%	54,6%	37,6%	77,4%	91%	74,9%	76,5%	61,3%
No change	17,4%	40,1%	52,4%	20,4%	8,7%	22,5%	21,2%	30,6%
Increase	1,8%	5,3%	10,0%	2,2%	0,4%	2,6%	2,3%	8,1%
	100%	100%	100%	100%	100%	100%	100%	100%
Change in production								
Decrease	65,6%	40,2%	23,2%	62,4%	91,1%	58,7%	61,4%	49,8%
No change	31,0%	54,3%	69,1%	34,0%	8,9%	37,2%	34,9%	42,9%
Increase	3,4%	5,4%	7,6%	3,7%	0%	4,1%	3,7%	7,3%
	100%	100%	100%	100%	100%	100%	100%	100%
Change in exports								
Decrease	39,5%	46,1%	29,2%	45,3%	n.a.	45,3%		53,9%
No change	58,5%	49,1%	69,2%	50,9%	n.a.	51%		41,5%
Increase	1,9%	4,8%	1,6%	3,8%	n.a.	3,8%		4,6%
	100%	100%	100%	100%	100%	100%		100%
Change in revenue								
Decrease	87,5%	64,3%	52,7%	84,3%	90,2%	82,8%	83,6%	71,1%
No change	9,3%	26,1%	29,9%	11,8%	5,1%	12,9%	12,3%	15,4%
Increase	3,2%	9,6%	17,4%	3,9%	4,7%	4,3%	4,1%	13,5%
	100%	100%	100%	100%	100%	100%	100%	100%
Change in sales								
Decrease	85,4%	58,4%	49,7%	81,6%	93,8%	79,5%	81,0%	64,7%
No change	13,8%	37,0%	38,5%	17,2%	6,2%	18,9%	17,6%	29,8%
Increase	0,8%	4,7%	11,8%	1,2%	0%	1,6%	1,4%	5,5%
	100%	100%	100%	100%	100%	100%	100%	100%
Change in profits								
Profits before and after	40,0%	68,3%	67,6%	44,3%	27,7%	46,44%	44,5%	68,0%
Profits before and no profit after	57,0%	26,9%	27,1%	52,4%	71,3%	50%	52,2%	28,0%
No profits before but profits after	0,2%	1,6%	0,3%	0,5%	0,0%	0,5%	0,4%	1,3%
No profits before and after	2,8%	3,2%	5,0%	2,8%	1%	3%	2,9%	2,7%
	100%	100%	100%	100%	100%	100%	100%	100%
Change in productivity								
Decrease	75,7%	60,1%	49%	73,7%	68%	73,2%	73,0%	65,3%
No change	10,0%	24,8%	22,1%	12,3%	21,6%	12%	12,6%	14,9%
Increase	14,4%	15,2%	28,8%	14,0%	10,5%	14,8%	14,4%	19,8%
	100%	100%	100%	100%	100%	100%	100%	100%

Source: Authors' own elaboration using EIFBS data.

Figure 3a. Performance by Location

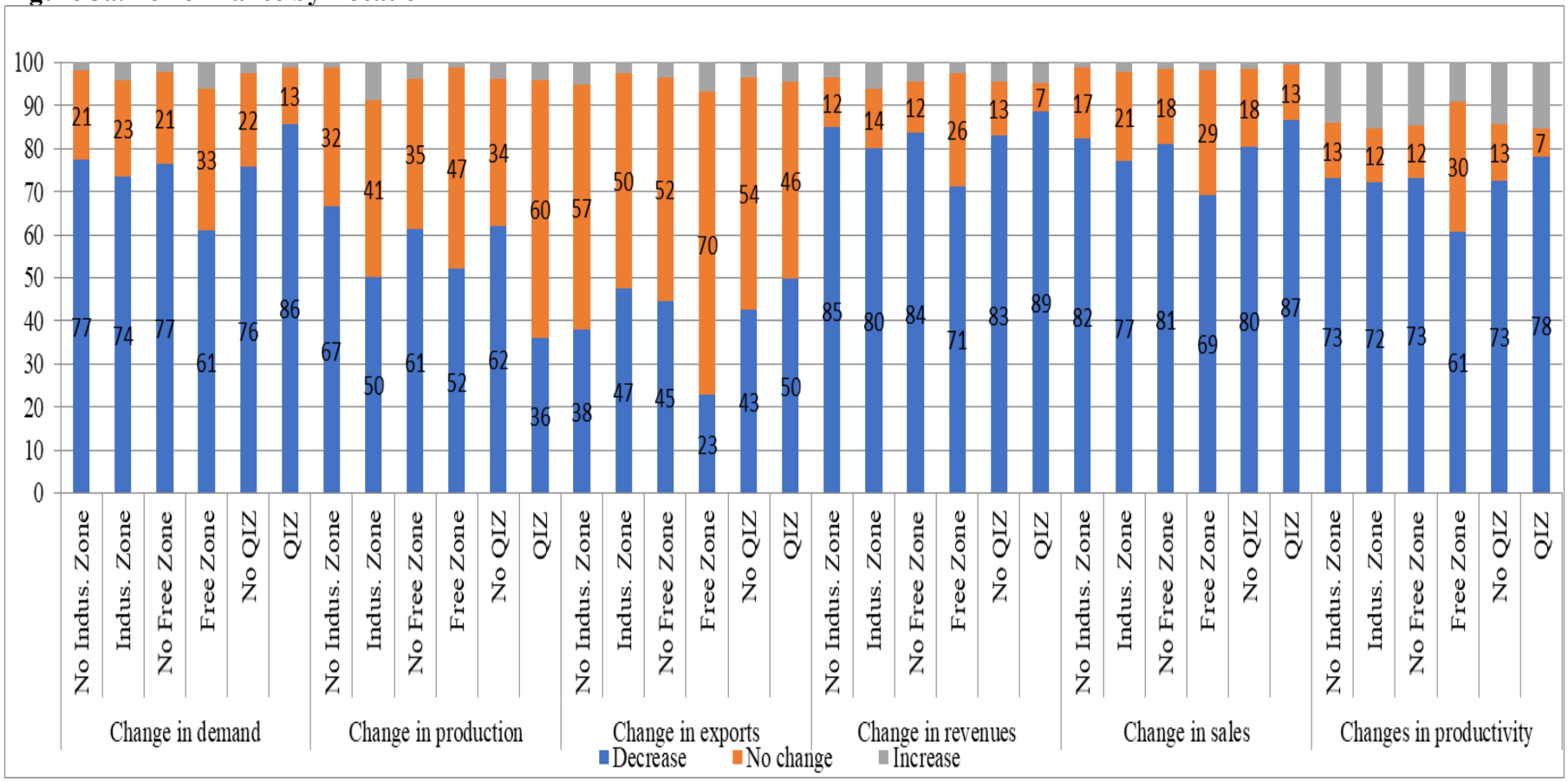
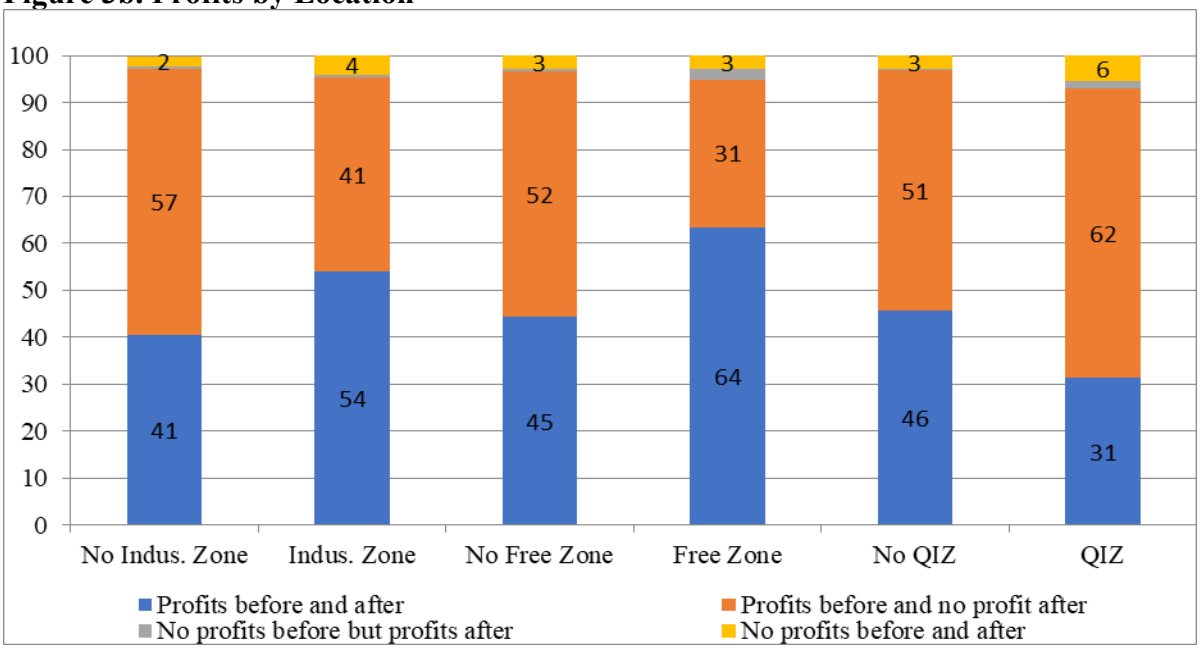


Figure 3b. Profits by Location



Source: Authors' own elaboration using EIFBS data.

Table 7. Performance by Owner's Characteristics

	Education				Experience		Gender			
	Below sec.	Secondary	Bachelor	Above	No exp.	Experience	No fem. Own.	Fem. Own	No fem mng	Fem. Mng
Change in demand										
Decrease	81,8%	88,0%	66,4%	49,6%	70,2%	78,7%	76,7%	71,6%	77,6%	63,7%
No change	17,2%	10,7%	29,9%	44,8%	27,1%	18,9%	21,0%	24,7%	20,3%	30,9%
Increase	0,9%	1,2%	3,6%	5,6%	2,7%	2,4%	2,3%	3,8%	2,1%	5,4%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Change in production										
Decrease	80,6%	63,3%	55,6%	47,6%	59,6%	61,5%	60,5%	64,6%	61,7%	56,1%
No change	18,5%	31,4%	41,5%	43,7%	37,3%	34,3%	35,6%	32,6%	34,7%	39,2%
Increase	0,9%	5,3%	2,9%	8,7%	3,0%	4,2%	3,9%	2,8%	3,7%	4,8%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Change in exports										
Decrease	33,6%	39,1%	42,6%	56,7%	40,7%	44,5%	37,4%	61,8%	36,4%	60,7%
No change	66,4%	60,2%	53,0%	41,8%	57,4%	51,3%	59,1%	34,2%	60,0%	35,6%
Increase	0,0%	0,6%	4,4%	1,5%	1,9%	4,2%	3,5%	4,0%	3,6%	3,7%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Change in revenue										
Decrease	79,7%	92,1%	77,6%	67,8%	80,3%	84,7%	83,2%	84,0%	84,0%	76,6%
No change	18,5%	6,2%	15,9%	16,7%	14,4%	11,4%	12,8%	9,7%	12,2%	14,1%
Increase	1,8%	1,7%	6,6%	15,4%	5,3%	3,9%	4,1%	6,4%	3,8%	9,3%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Change in sales										
Decrease	80,7%	89,1%	74,6%	59,1%	78,5%	81,4%	80,7%	78,9%	81,7%	70,4%
No change	18,4%	9,9%	23,6%	33,2%	19,8%	17,2%	17,8%	19,5%	17,0%	26,3%
Increase	0,9%	1,0%	1,8%	7,8%	1,7%	1,4%	1,5%	1,6%	1,3%	3,3%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Change in profits										
Profits before and after	30,5%	36,8%	54,3%	60,7%	52,9%	41,4%	45,8%	40,5%	44,6%	49,1%
Profits before and no profit after	69,2%	61,2%	40,5%	37,1%	44,0%	55,2%	50,9%	55,8%	52,1%	47,2%
No profits before but profits after	0,0%	0,2%	0,7%	0,8%	0,1%	0,6%	0,5%	0,3%	0,5%	0,3%
No profits before and after	0,3%	1,8%	4,4%	1,4%	2,9%	2,8%	2,8%	3,4%	2,8%	3,4%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Change in productivity										
Decrease	78,1%	73,4%	71,3%	71,4%	73,0%	72,7%	72,7%	73,6%	72,9%	71,9%
No change	18,0%	8,9%	14,8%	7,8%	13,9%	12,0%	13,4%	7,5%	12,7%	12,2%
Increase	3,9%	17,7%	13,9%	20,8%	13,1%	15,3%	13,8%	18,9%	14,3%	15,9%
	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Source: Authors' own elaboration using EIFBS data.

Table 8. Performance by Managerial Practices, Technology and Innovation

	Technology adoption		Innovation		Managerial Practice		Worker Training	
	No Tech.	Tech.	No R&D	R&D	No good practice	Good practice	No Training	Training
Change in demand								
Decrease	84,4%	57,0%	80,8%	43,3%	87,3%	62,2%	87,8%	68,7%
No change	13,9%	38,8%	17,3%	50,3%	11,0%	34,4%	10,1%	28,6%
Increase	1,7%	4,2%	1,9%	6,5%	1,7%	3,4%	2,1%	2,7%
	100%	100%	100%	100%	100%	100%	100%	100%
Change in production								
Decrease	68,6%	43,8%	65,4%	30,6%	69,9%	50,0%	66,1%	57,8%
No change	27,5%	52,6%	30,9%	64,6%	26,2%	46,2%	28,0%	39,7%
Increase	3,9%	3,6%	3,6%	4,8%	3,8%	3,7%	5,9%	2,5%
	100%	100%	100%	100%	100%	100%	100%	100%
Change in exports								
Decrease	51,8%	40,7%	52,1%	36,9%	38,5%	44,8%	51,7%	42,4%
No change	46,1%	55,1%	46,3%	57,9%	60,2%	51,0%	48,3%	53,4%
Increase	2,2%	4,1%	1,6%	5,2%	1,3%	4,1%	0,0%	4,1%
	100%	100%	100%	100%	100%	100%	100%	100%
Change in revenue								
Decrease	88,1%	71,8%	86,5%	61,0%	91,0%	73,7%	91,0%	78,5%
No change	9,2%	19,8%	10,0%	28,8%	7,0%	19,0%	7,1%	15,6%
Increase	2,6%	8,4%	3,5%	10,2%	2,0%	7,2%	1,9%	5,9%
	100%	100%	100%	100%	100%	100%	100%	100%
Change in sales								
Decrease	86,8%	66,0%	85,4%	46,5%	88,6%	70,5%	87,9%	75,9%
No change	12,2%	31,3%	13,4%	49,9%	10,5%	27,3%	11,4%	22,1%
Increase	1,0%	2,7%	1,2%	3,7%	0,9%	2,3%	0,7%	2,1%
	100%	100%	100%	100%	100%	100%	100%	100%
Change in profits								
Profits before and after	38,5%	60,2%	43,3%	58,0%	34,6%	58,1%	39,7%	48,5%
Profits before and no profit after	58,6%	35,4%	53,5%	37,6%	62,6%	37,9%	57,7%	47,7%
No profits before but profits after	0,2%	1,0%	0,3%	1,5%	0,3%	0,7%	0,2%	0,6%
No profits before and after	2,7%	3,5%	2,9%	2,9%	2,5%	3,3%	2,4%	3,2%
	100%	100%	100%	100%	100%	100%	100%	100%
Change in productivity								
Decrease	75,1%	67,5%	74,8%	59,5%	76,8%	67,9%	73,1%	72,7%
No change	10,5%	17,6%	10,5%	27,5%	8,2%	18,2%	9,5%	14,6%
Increase	14,4%	14,8%	14,7%	13,0%	15,0%	13,9%	17,4%	12,7%
	100%	100%	100%	100%	100%	100%	100%	100%

Source: Authors' own elaboration using EIFBS data.

Firm Characteristics

All firms have reported large falls in demand and production (Table 6). Quite a few of their more fortunate counterparts reported increases in these measures. For instance, only 3.7 % of private firms increased real production, whereas over than double that number (7.6%) of publicly owned firms have done so. SMEs, private, informal and non-exporting firms are also more likely to have falling revenues and profits. Productivity follows the same pattern.

Public firms have for years enjoyed greater protection compared to their private sector counterparts through the provision of cheap state credit and a soft budget constraint resulting in the bailing out of public companies in crisis.[13] Not only that, public firms are relatively more concentrated in the more resilient sector, food: 40% of all public firms are in the food sector (excluding bakeries) but only 19% of private firms, with over a quarter (26%) less decreases in capacity utilization in food compared to the largest decreases in the textiles sector.[14] The findings here echo the fact that the private sector in Egypt continues to face a number of institutional and competition-related barriers that hinder its expansion (World Bank, 2020).

There is broad agreement in the trade literature that exporting firms have higher productivity than non-exporting ones (Melitz 2003, Fernandes and Isgut, 2005, Greenaway and Kneller, 2008 and Feng et al., 2016). This fact is chiefly attributed to a self-selection process: firms taking up exporting are already the most productive ones and are able to afford the high fixed-costs of entering foreign markets. An alternative explanation is the learning-by-exporting theory, where firms become more productive through exporting. The literature is not conclusive on the expected effects of the pandemic on exporters. A first strand argues that the international exposure of exporting firms increases their vulnerability and makes them more likely to be affected by external shocks. A second strand shows that they are less affected as they are, on average, more productive and more able to sustain their activities in times of crisis. Our results support this second view. As indicated above, exporters are generally more resilient with substantially better performance indicators (Table 6).

Firm Location

In terms of location, performance indicators for industrial zones and free zones are generally better than their non-zone counterparts, though this is not true of QIZ firms. Reported profits are also substantially higher both before and after the crisis for industrial and free zone firms, that are also mostly exporting firms. Fewer of these firms report being unprofitable after the crisis (Figure 3a and b).

[13] Softening of the budget constraint occurs when the strict relationship between expenditure and earnings has been relaxed because excess of expenditure over earnings will be paid by some other institution, typically the state. A further condition of softening is that the decision maker expects such external financial assistance with high probability, and this probability is built firmly into his behavior" Kornai, 1986 Kornai, the first one to use this terminology, argues that there are different ways to soften the budget constraint of the firm: through 1) soft subsidies, 2) soft taxation, 3) soft credit and; 4) soft administrative prices (ibid.). For a literature review on soft budget constraints see Maskin (1999).

[14] 86% if textiles firms have reported decreases in capacity utilization whereas only 60% of firms in the food sector have.

Owner's Characteristics

More educated firm owners and firms with women in top management report substantially fewer falls in demand, production, sales and revenues (Table 7). Firms with more educated owners also report higher profits and fewer falls in profitability, which is not the case for women managers (Table 7). The entrepreneurial skills of managers are an important determinant of firm success and survival (Argenti, J. 1976, Cormie 1991, Hampel-Milagrosa et al. 2015, Kottica et al. 2020). Entrepreneurial skills are also known to be associated with education (Camelo-Ordaz et al. 2005, Niñerola et al. 2016, Vispute 2020).

Managerial Practices

Certain pre-pandemic managerial practices have paid off. The adoption of advanced technology, investing in R&D and innovation, setting managerial targets monitoring firm performance, and training are all strongly associated with post-pandemic firm performance (Table 8). Decreases in demand for firm products and declines in production, sales, profitability and productivity are considerably less when managers utilize technology and undertake firm-specific R&D. Only 57% of firms that employ technology have reported declines for the demand on their products, compared to 84.4% for firms which do not. Firms with the lowest likelihood of falls in production are those that invest in R&D, only 30.6% compared to more than double that of other firms 65,4%). Firms adopting innovative technologies are most likely to have been profitable both before and after the crisis (Table 8).

These results are consistent with existing literature showing that technology adoption and innovation are important for firm survival. Giovannetti et al. (2011) show that size of the firm combined with technology is a sufficient condition for firm survival. Cefis and Marsili (2019) demonstrate that new firms innovating within two years from their founding enjoy a long-term adaptive survival premium during and after a crisis. Unlike previous crisis, the COVID-19 crisis distinguishes itself in the role technology played in the opportunity for firms to cope with the new normal and adopt adaptive business models, and to benefit from increased demand for technology products such as software and online platforms. As stated by Pansiri and Temtime (2008), 'managerial effectiveness could by definition have avoided or at least minimized [problems'] impact on firm survival' (p. 252).

4. Government Support

Egypt's government has taken a number of fiscal and monetary measures to contain the outbreak's effects on the economy, which had been gradually recovering since the 2011 political upheavals.

Similar to other nations, the government rolled out a full-fledged stimulus package to absorb the shock of the pandemic. Fiscal measures to support the economy and the financial markets included: lowering the price of electricity for industrial use by 10 piasters per kilowatt hour (kWh) for the medium, high and ultra-high usage tiers, and freezing rates for the next 3-5 years; reducing real

estate tax payment settlements for industrial and tourism companies and stamp duty on EGX transactions from 0.15% to 0.125% for foreign investors and 0.05% for local investors; postponing the capital gains tax on stock market transactions and permanently exempting foreign investors from the duty; cutting tax on dividends by 50%; fast-tracking payouts from the Export Subsidy Fund; expanding the Social Security and Pension Act's coverage; providing one-time stipends of EGP 500 for seasonal and temporary workers; postponing the filing deadline for auditors and SMEs; reducing the price of natural gas for industry to $4.5 per million British thermal unit (mmbtu) (El-Haddad 2020b).

Monetary policy measures included cutting benchmark rates by 300 basis points (bps) to encourage industrial sector growth and capital expenditure lending, help shrink the budget deficit (given the new expansionary fiscal measures) and stimulate foreign investments on the stock market. Expansionary measures included postponing all bank loan repayments for businesses and retail clients for a six-month period; launching a debt relief initiative for individual borrowers; and cutting discount rates for the Central Bank of Egypt's factories financing initiative (Ramadan and Zaki 2020).

4.1. Who Received Government Support?

There are two important considerations in thinking about government support. The first is linked to vulnerability and equity: whether to target sectors and/or firm types (e.g. micro and SMEs) most affected by the crisis, or those sectors or firms whose performance are most likely to be significantly improved with limited support. So rather than help the most in need, help the least in need of those in need. This is similar to considering targeting on poverty headcount versus the depth of poverty. Another analogy is the triage argument in medicine that when resources are limited those with the highest likelihood of survival should be supported and not those with the lowest. Perhaps there is no point wasting resources on firms with poor survival prospects – on the other hand, shouldn't assistance go to the most vulnerable?

The second consideration is the effectiveness of the actual support received by sectors or firms? Did it prevent firm closures, the laying off of workers or large reductions in capacity utilization and sales? We are unable to answer the second question with this descriptive analysis but will do so in a subsequent paper.

The survey collected data about the government support before and after the crisis. We inquired about 17 types of potential support measures covering the range of monetary and fiscal dimensions of support. Below we identify who received any of the possible support measures. We follow the ISIC Rev.4 classification at the 2-digit level, which gives us 19 manufacturing sectors.

Which Sectors?

The largest recipients post-pandemic were firms in the manufacture of fabricated metals products[15] such as weapons and ammunitions, reservoirs and boilers, metal frameworks (for the automotive industry) or skeletons for towers and bridges. Forty percent of all firms in this sector received government support post pandemic. Next in government support are manufacture of wood (36% of firms), textiles (35%), rubber (30%) and pharmaceuticals (28%) (Figure 4a).

Tables 9a and b give details of the changes in all economic indicators by sector. The five most affected sectors are the manufacture of wood and wood products except furniture, furniture, textiles, clothing, non-metallic minerals, and basic metals (i.e. iron and steel) (Table 10). Thus, two of the top five affected sectors in this survey have accessed government support but clothing, furniture, non-metallic minerals sector and basic metals among the top seven badly affected sectors are less likely to have received support.[16]

Since we do not observe effects on those firms that have closed prior to the survey nor do we observe the counterfactual, thus it is hard to assess whether support reached the most vulnerable or how effective government support has been as mentioned earlier. Nonetheless, we can say that:

1) Government support went to two of the most (export) sectors in need (wood and textiles).
2) Despite government support to these wood and textiles sectors, they are the top two sectors adversely affected by the pandemic for demand, capacity utilization, revenues, exports and employment, potentially confirming their increased exposure to this global shock.
3) Support also went to sectors least in need of support such as the manufacture of fabricated metals products, rubber and pharmaceuticals.
4) Possibly, because these sectors received government support they are not currently the worst performing sectors. Notably, fabricated metals which received the most support is not in the top six adversely affected sectors (Table 10). Similarly, pharmaceuticals is one of the best performing sectors, in fact one of the four sectors that have witnessed increases in exports, production and revenues, yet it is among the top five sectors that received government support. These other sectors are computer and electronics, chemicals, coke and refined petroleum products and electrical equipment sectors.

[15] Except machinery and equipment

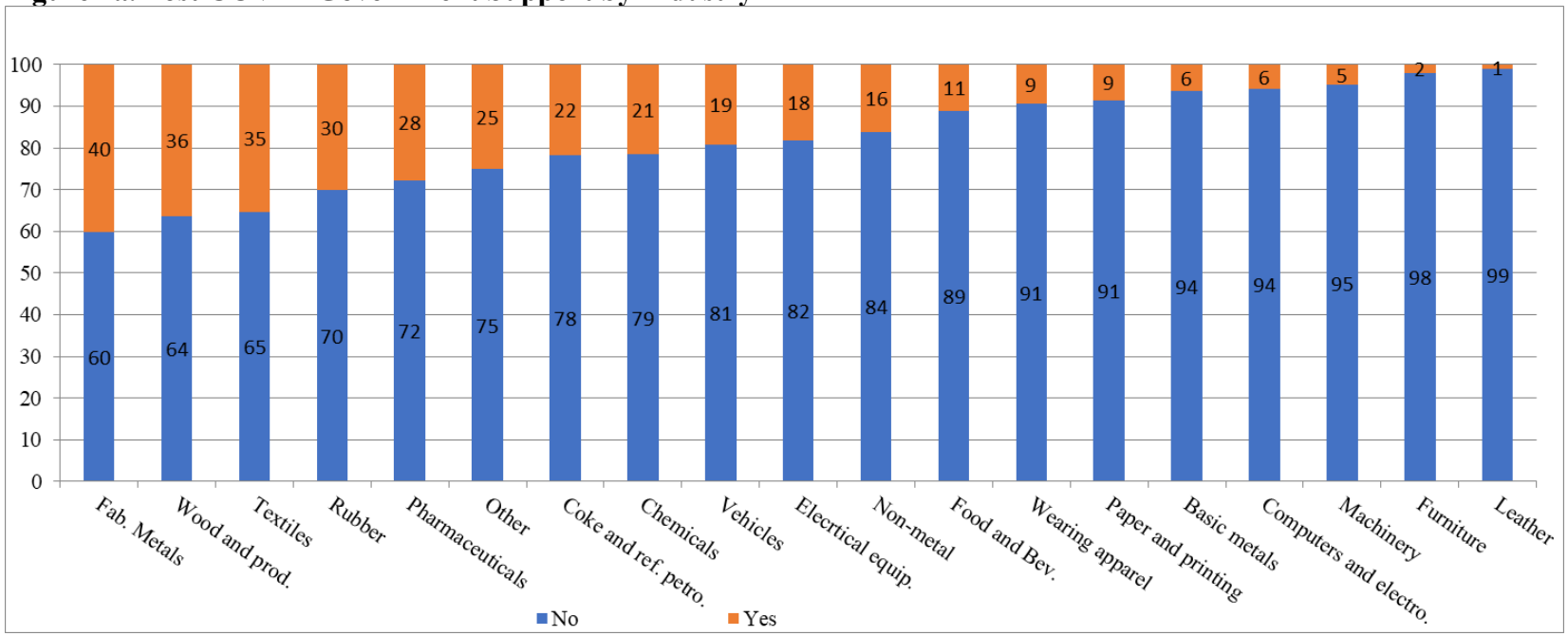
[16] Though the paper sector has also been badly damaged especially in terms of capacity utilization. So one can state that three out of the six most damaged sectors have accessed support.

Which Firm Size?

Our results have confirmed results from other countries (cf. Freund 2021; Cirera et al. 2021; El-Haddad et al. forthcoming) that SMEs have suffered more as a result of COVID-19 compared to large firms. But has support flown to these most vulnerable small firms?

The survey shows that it is not so. There are substantial disparities by firm size. The probability of accessing government support ranges from 16% for SMEs to 23% among large firms (Figure 4b). Extra large firms – with greater than 600 workers - are nearly three times as likely to have accessed government support compared to small firms (30% versus 11%). This result is expected where SMEs are privately owned with no access to capital markets, and limited access to bank loans. Prior to the COVID pandemic the share of small firms in total bank loans was only 8,8% compared to a share of 60% of large firms (those with over 100 workers).

Figure 4a. Post COVID Government Support by Industry



Source: Authors' own elaboration using EIFBS data.

Table 9a. Economic Effects by Sector

		Change in Demand			Change in Production			Change in Cap. Utilization			Change in Employment			
		Decrease	No change	Increase	Decrease	No change	Increase	Decrease	No change	Increase	Decrease	No change	Increase	Total
Food and Bev.	10	64%	33%	3%	52%	44%	4%	60%	39%	0%	28%	68%	4%	100%
Textiles	13	88%	11%	0%	79%	20%	1%	86%	14%	0%	62%	37%	1%	100%
Wearing apparel	14	86%	11%	2%	68%	31%	1%	78%	22%	0%	46%	49%	5%	100%
Leather	15	94%	6%	0%	51%	49%	0%	34%	66%	0%	28%	72%	0%	100%
Wood and prod.	16	89%	11%	0%	69%	29%	1%	73%	27%	0%	30%	34%	36%	100%
Paper and printing	17	54%	44%	2%	66%	32%	2%	79%	20%	1%	26%	42%	32%	100%
Coke and ref. petro.	19	55%	9%	36%	55%	24%	21%	55%	45%	0%	1%	97%	1%	100%
Chemicals	20	45%	44%	10%	44%	53%	3%	62%	37%	1%	24%	67%	8%	100%
Pharmaceuticals	21	33%	48%	20%	33%	56%	11%	47%	53%	0%	18%	66%	16%	100%
Rubber	22	64%	33%	3%	53%	44%	3%	66%	33%	1%	13%	82%	5%	100%
Non-metal	23	87%	12%	1%	71%	24%	5%	83%	17%	0%	29%	70%	1%	100%
Basic metals	24	83%	13%	4%	67%	32%	1%	75%	25%	1%	39%	52%	10%	100%
Fab. Metals	25	72%	24%	4%	59%	38%	3%	70%	28%	2%	14%	84%	1%	100%
Computers and electro.	26	39%	46%	14%	39%	59%	1%	29%	60%	12%	0%	100%	0%	100%
Electrical equip.	27	60%	39%	1%	35%	64%	0%	43%	57%	0%	14%	80%	7%	100%
Machinery	28	81%	19%	0%	65%	33%	1%	64%	36%	0%	5%	79%	16%	100%
Vehicles	29	61%	26%	13%	55%	43%	3%	55%	45%	0%	22%	75%	3%	100%
Furniture	31	89%	11%	0%	59%	14%	27%	78%	22%	0%	40%	55%	5%	100%
Other	32	68%	32%	0%	55%	45%	0%	68%	32%	0%	9%	91%	0%	100%

Source: Authors' own elaboration using EIFBS data.

Table 9b. Economics Effects by Sector

		Change in Exports			Change in Revenue			Change in Sales			Change in Profit				
		Decrease	No change	Increase	Decrease	No change	Increase	Decrease	No change	Increase	Profits before & after	Profits before & no profit after	No profits before but profits after	No profits before and after	Total
Food and Bev.	10	43%	47%	10%	70%	24%	6%	68%	29%	3%	97%	3%	0%	0%	100%
Textiles	13	47%	52%	1%	93%	4%	3%	94%	6%	0%	70%	28%	0%	3%	100%
Wearing apparel	14	45%	51%	4%	92%	7%	1%	89%	11%	0%	69%	31%	0%	0%	100%
Leather	15	55%	45%	0%	95%	5%	0%	95%	5%	0%	65%	30%	1%	4%	100%
Wood and prod.	16	88%	12%	0%	91%	5%	4%	90%	10%	0%	65%	28%	3%	4%	100%
Paper and printing	17	40%	60%	0%	87%	11%	2%	81%	17%	2%	64%	32%	2%	1%	100%
Coke and ref. petro.	19	50%	50%	0%	63%	0%	38%	55%	9%	32%	63%	31%	0%	5%	100%
Chemicals	20	36%	62%	2%	68%	18%	14%	62%	33%	5%	60%	40%	0%	0%	100%
Pharmaceuticals	21	49%	46%	5%	48%	22%	31%	44%	39%	16%	58%	42%	0%	0%	100%
Rubber	22	43%	53%	4%	75%	20%	5%	71%	27%	3%	52%	48%	0%	0%	100%
Non-metal	23	44%	50%	5%	86%	9%	5%	86%	14%	1%	47%	35%	15%	3%	100%
Basic metals	24	47%	53%	0%	83%	7%	9%	81%	19%	1%	42%	54%	0%	4%	100%
Fab. Metals	25	21%	79%	0%	79%	13%	8%	74%	24%	2%	38%	54%	0%	8%	100%
Computers and electro.	26	17%	66%	17%	68%	16%	16%	40%	50%	13%	33%	63%	1%	3%	100%
Elecrtical equip.	27	48%	50%	2%	67%	33%	0%	68%	32%	0%	33%	64%	0%	3%	100%
Machinery	28	45%	55%	0%	74%	25%	2%	83%	18%	0%	27%	68%	0%	4%	100%
Vehicles	29	50%	50%	0%	71%	29%	0%	53%	47%	0%	24%	75%	0%	1%	100%
Furniture	31	91%	9%	0%	96%	1%	3%	89%	11%	0%	22%	76%	0%	2%	100%
Other	32	7%	93%	0%	78%	21%	2%	55%	44%	1%	7%	91%	0%	2%	100%

Source: Authors' own elaboration using EIFBS data.

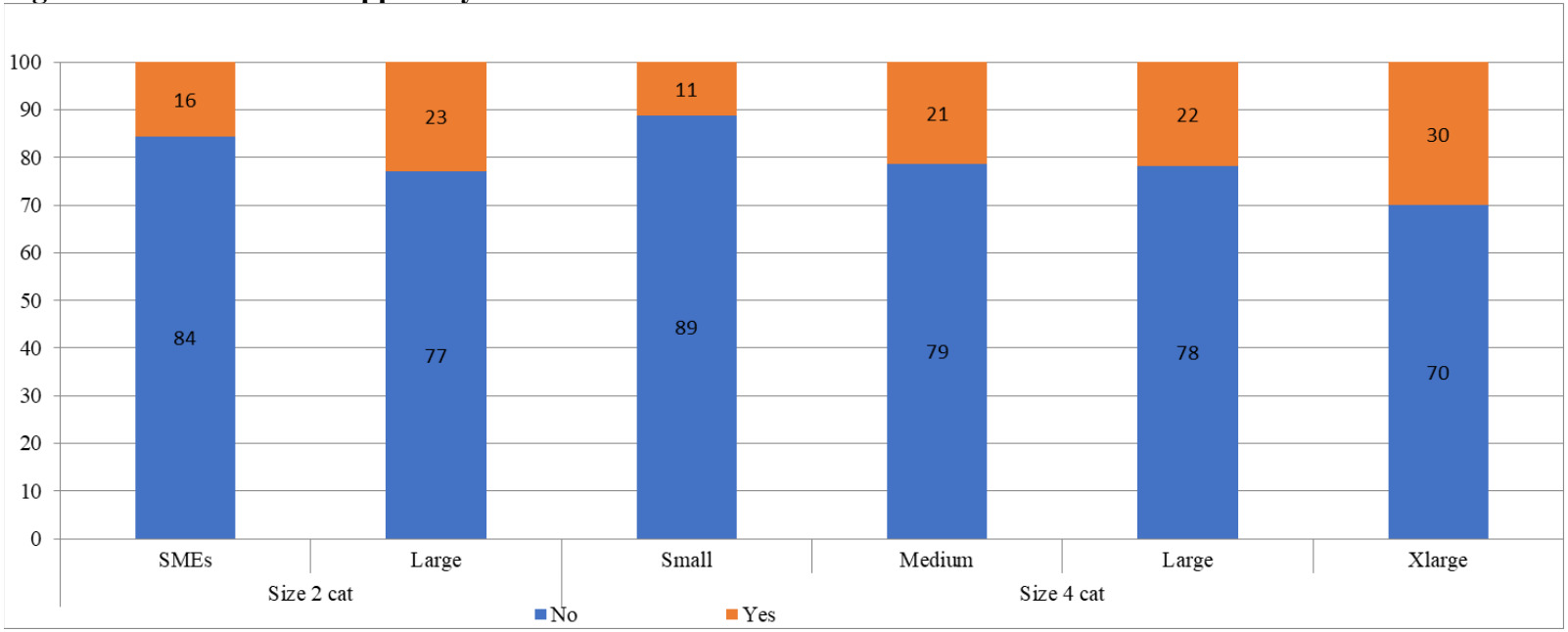
Table 10. Top 6 Sectors damaged versus Top 5 with government Support

	production	capacity utilization	sales	revenue	exports	profits	employ	demand
sectors with most economic damages								
Wood	√	√	√	√	√	x	√	√
Furniture	x(9^{th})	√	√	√	√ (1^{st})	√	√	√
Textiles	√	√	√	√	x(8^{th})	x	√	√
Clothing	√	√	√	√	X	x	√	√
Non metallic	√	√	√	√	x	x	√	√
Basic metals	√	√	X (high 81)	x (8^{th} high)	x	X	√	√
sectors with most received government support								
Fab. Metal	x	x	x	x	x	x	x	x
Paper	√	√	x	√	x	x	x(9^{th})	x
Wood	√	√	√	√	√	x	√	√
Textiles	√	√	√	√	x(8^{th})	x	√	√
Rubber	x	x	x	x	x	x	x	x
Pharma	x last	x	x (b4 last)	x (last)	x (6^{th} banned)	x last	x	x (last)
Basic metals	√	√	x (high 81)	x (8^{th} high)	x	x	√	√
Machinery	√	x	√	x	x	√	x	x (8^{th})

Source: Authors' own elaboration using EIFBS data.

Note: tick marks indicate that the sector is among the top five most affected sectors in terms of the corresponding indicator. An x indicates that it is not.

Figure 4b. Government Support by Size



Source: Authors' own elaboration using EIFBS data.

5. Conclusion

We use data from the 2020/21 Egyptian Industrial Firm Behavior Survey (EIFBS) to assess the effects of the COVID-19 crisis on firm dynamics, behavior and performance. The crisis emanating from the COVID-19 pandemic induced both demand and supply side shocks which are more far reaching than any crisis in living memory.

Our results show that the crisis has hit the entire Egyptian manufacturing sector. But, in line with Schumpeter's (1934) creative destructive theory, and in contrast to post-pandemic results from Bosio et al. (2020), the market shows signs of 'self-cleansing', whereby the less efficient are more likely to exit and downsize their activities. Our results distinguish between 'status variables' which are largely exogenous and those which are shaped by the behavior of the firm such as managerial practices, innovation and adoption of technology, or worker training. In contrast, exogenous factors are not entirely in the control of firms, such as being informal, solely catering to the domestic market or being in the private sector.

Our preliminary descriptive results presented in this paper show resilience of larger, public, formal, and export sector firms. Thus revealing the pre-existing fragilities of the private, informal and, more generally the lower productivity firms of the manufacturing sector. These results confirm the dire need of structural reforms across the Egyptian manufacturing sector to address the underlying structural constraints that limit firms' productivity. Such reforms include an effective competition policy, eliminating the 'soft budget constraint' as well as proper investment in education and health and paying attention to taxation and the business environment. The results also show that the government chooses to support those with potentially better chances of survival rather than support the most vulnerable.

In summary, our results show that over one-fifth of the sample's firms exited, temporarily closed or were only partially functioning. Larger, public sector, formal and exporting firms are more likely to be fully functioning and less likely to have ever closed. These firms have also reduced their capacity utilization and employment much less than other firms. SMEs, private, informal and non-exporting firms are more likely to have declining revenues and profits. Productivity follows the same pattern. These findings support the argument that public firms face a soft budget constraint, and that exporting firms are more productive and thus able to sustain their activities in times of crisis, and, finally, that formal and larger firms are more resilient.

More surprising is the finding that over a quarter of informal firms have increased employment. As a 'survival sector' which provides 'helping hand employment' the relation between the formal and informal sector is counter-cyclical. Contraction of the formal sector expands the informal as the only alternative way to earn a living.

Existing literature suggests that the ability to adapt to market conditions is a crucial determinant of firm survival. Consistent with this literature, good pre-pandemic managerial practices are shown to have paid off. The adoption of advanced technology, investing in R&D and innovation, setting managerial targets, monitoring firm performance, and training are all strongly associated with reduced likelihood of exit, temporary closures and partial functioning. These practices are also associated with better post-pandemic revenues and profits (performance) and fewer reductions in capacity utilization and employee layoffs (behavior).

Some nuances are present in the data. (1) Firms in industrial and free zones show mixed results. They are very similar to non-zone counterparts in terms of operational status and firm behavior, however their performance post-pandemic is generally better. (2) Owner education matters for better dynamics and performance (when excluding traditional subsidized bakeries which have done well through the pandemic). More educated firm owners and firms with women in top management report substantially fewer reductions in demand, production, sales and revenues. Firms with more educated owners also report higher profits and fewer falls in profitability, though this is not the case for women managers. (3) The five most affected sectors are the manufacture of wood and wood products except furniture, furniture, textiles, clothing, non-metallic minerals and basic metals. Firms in the manufacture of fabricated metals products, of wood, textiles, rubber and pharmaceuticals were the largest recipients of government support. Hence, government support went to two of the five most sectors in need.

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Annex 1: Sampling Weights:

The 2017 economic census: the establishments were classified into many strata (about 252 strata) based on the economic activity (2 digits) and the number of employees (1- 4, 5-9 and 10+), and the selected probability of the establishment from the strata number h in the governorate (9 governorates) number i is calculated as

$$\boldsymbol{P_{hi} = \frac{n_{hi}}{N_{hi}}},$$

where P_{hi} is the probability of selecting the establishment from the strata number h in the governorate number i , n_{hi} is the sample size in the strata number h the governorate number i, and $\boldsymbol{N_{hi}}$ is total number of establishments in the strata number h in the governorate number i.

The response rate in the strata number h is calculated as

$$\boldsymbol{R_{hi} = \frac{C_{hi}}{E_{hi}}},$$

where R_{hi} is response rate in the strata number h in the governorate number i , $\boldsymbol{C_{hi}}$ is the number of completed establishments and $\boldsymbol{E_{hi}}$ is the number of eligible establishments in the strata number h in the governorate number i.

The 2020 Egyptian industrial firm behavior survey: the establishments were classified into many strata based on the governorates economics activity (2 digits) and the number of employees (5- 19, 20-100, 101-400 and 401+) in the governorate number i, and the selection probability of the establishment from the strata number h in the governorate number i is calculated as

$$\boldsymbol{P_{ri} = \frac{n_{ri}}{N_{ri}}},$$

where P_{ri} is the probability of selecting the establishment from the strata number r in the governorate number i, n_{ri} is the sample size , and $\boldsymbol{N_{ri}}$ is total number of establishments in the 2017 economic census in the strata number r in the governorate number i.

The response rate in the strata number r in the governorate number i calculated as

$$\boldsymbol{R_{ri} = \frac{C_{ri}}{E_{ri}}},$$

where R_{ri} is response rate in the strata number h in the governorate number i, $\boldsymbol{C_{ri}}$ is the number of completed establishments and $\boldsymbol{E_{ri}}$ is the number of eligible establishments in the strata number r in the governorate number i.

The weight of the k^{th} establishment in the economic census strata number h and the Egyptian industrial firm behavior survey strata number r in the governorate number i is calculated as

$$W_{khri} = \frac{1}{P_{hi}R_{hi}P_{ri}R_{ri}P_i} \ ,$$

where P_i is the selection probability of the governorate number i is calculated as

$$P_i = \frac{3N_i}{N_s},$$

where N_i is total number of establishments in the 2017 economic census in the governorate number i and N_s is total number of establishments in the 2017 economic census in the region of governorate number i

Finally, the above weights are standardized (for more on weights see Annex 1).

Annex 2: Closures and Operational Status Excluding Bakeries

Table 1. Closures and Operational Status Excluding Bakeries

			Current Status of the Firm				Ever closed since start of COVID		Total	Diff. btw bottom n top fully func. cat. without bakeries	Diff. btw bottom n top fully func. cat. with bakeries	Absolute diff.
			Exited	Temp. closed	Partially func.	Fully func.	YES	NO				
Firms' Characteristics	WB size	Micro	1,1%	12,6%	35,5%	50,8%	60,4%	39,6%	100%			
		Small	0,5%	0,7%	22,3%	76,4%	47,4%	52,6%	100%			
		Medium	0,3%	2,1%	38,4%	59,3%	42,7%	57,3%	100%			
		Large	0,0%	1,0%	14,6%	84,4%	27,7%	72,3%	100%	33,8%	7,5%	26,3
	Size	SMEs	0,5%	2,4%	30,4%	66,8%	46,5%	53,5%	100%			
		Large	0,0%	1,0%	14,6%	84,4%	27,7%	72,3%	100%	17,6%	7,4%	10,2%
	Formality	Informal	0,0%	5,5%	43,6%	50,9%	58,4%	41,6%	100%			
		Formal	0,5%	1,3%	23,1%	75,2%	39,0%	61,0%	100%	24,2%	16,1%	8,1%
	Exp. Status	No	0,4%	2,2%	27,9%	69,5%	43,6%	56,4%	100%			
		Yes	0,2%	0,3%	11,0%	88,5%	26,5%	73,5%	100%	19,1%	10,6%	8,4%
	Firm Ownership	Public	0,0%	0,3%	13,9%	85,8%	13,2%	86,8%	100%			
		Private	0,5%	2,3%	28,0%	69,3%	44,3%	55,7%	100%	-16,5%	-19,3%	2,7%
Location	Indus Zones	No	0,0%	3,1%	31,8%	65,1%	43,9%	56,1%	100%			
		Yes	1,1%	0,5%	19,1%	79,3%	41,7%	58,3%	100%	14,2%	2,3%	11,9%
	Free Zones	No	0,4%	2,1%	27,7%	69,8%	42,9%	57,1%	100%			
		Yes	0,0%	5,5%	20,3%	74,3%	52,6%	47,4%	100%	4,5%	2,9%	1,6%
	QIZ	No	0,4%	2,2%	27,7%	69,6%	43,3%	56,7%	100%			
		Yes	0,6%	1,3%	21,9%	76,2%	40,2%	59,8%	100%	6,5%	-1,7%	8,3%
Owners' Characteristic	Education	Below sec.	0,0%	0,0%	26,2%	73,8%	44,9%	55,1%	100%			
		Seondary	0,9%	3,3%	35,7%	60,1%	52,0%	48,0%	100%			
		Bachelor	0,1%	1,9%	21,5%	76,5%	36,1%	63,9%	100%			
		Above	0,0%	0,0%	19,8%	80,2%	34,5%	65,5%	100%	6,4%	-2,7%	9,1%

			Current Status of the Firm				Ever closed since start of COVID		Total	Diff. btw bottom n top fully func. cat. without bakeries	Diff. btw bottom n top fully func. cat. with bakeries	Absolute diff.
			Exited	Temp. closed	Partially func.	Fully func.	YES	NO				
	Experience	No	0,1%	2,2%	21,1%	76,6%	40,7%	59,3%	100%			
		Yes	0,5%	2,2%	30,7%	66,6%	44,1%	55,9%	100%	-10,0%	-11,9%	2,0%
	Female Own.	No	0,4%	2,2%	26,5%	70,8%	43,0%	57,0%	100%			
		Yes	0,0%	1,9%	34,2%	63,9%	44,1%	55,9%	100%	1,1%	-4,6%	5,8%
	Female Mng.	No	0,4%	2,4%	27,2%	69,9%	43,8%	56,2%	100%			
		Yes	0,0%	0,4%	29,7%	69,9%	38,1%	61,9%	100%	-5,7%	-0,2%	-5,6%
Management practices, Technology and Innovation	Technology	No	0,5%	2,7%	32,6%	64,2%	49,1%	50,9%	100%			
		Yes	0,0%	1,0%	15,9%	83,2%	29,7%	70,3%	100%	19,0%	6,9%	12,1%
	R & D	No	0,4%	2,5%	30,3%	66,8%	46,3%	53,7%	100%			
		Yes	0,0%	0,1%	8,2%	91,7%	21,0%	79,0%	100%	24,9%	15,1%	9,8%
	Good Prac.	No	0,5%	2,9%	40,6%	56,0%	50,4%	49,6%	100%			
		Yes	0,3%	1,3%	11,2%	87,2%	34,2%	65,8%	100%	31,2%	17,1%	14,2%
	Training	No	0,7%	3,0%	37,9%	58,4%	50,9%	49,1%	100%			
		Yes	0,2%	1,7%	20,9%	77,2%	38,3%	61,7%	100%	18,8%	8,7%	10,1%

Source: Authors' own elaboration using EIFBS data.